CLAIMS

1. A method for measuring the wave aberrations of the eye, based on probing the eye with a narrow laser beam, detection of the radiation scattered by the retina, measurement of the wave front tilt in the form of the first partial derivatives along the coordinates in a discrete set of pupil points with known coordinates, approximation of the wave front in the form of functions of pupil coordinates using said data, and calculation of wave aberrations of the eye as deformations of the approximated wave front, *c h a r a c t e r i z e d* in that the partial derivatives at any pupil point are determined by means of spline approximation using the values in a discrete set of points, where the wave front tilts are measured, and the wave front is reconstructed by means of the numerical integration.

2. A method according to claim 1, wherein the wave front reconstructed by means of the numerical integration is along the radii with the initial point of integration located in the center of the pupil, where identical initial values of the integral are taken for all radii.

3. A method according to claim 1, *c h a r a c t e r i z e d* in that the discrete set of points, in which the wave front tilt is measured, is located along concentric circles with the common center, which coincides with the center of coordinates.

4. A method as in claim 3, *c h a r a c t e r i z e d* in that the approximation of partial derivatives at the beginning is performed along each concentric circle and then along radii.

5. A method according to claim 1, *c h a r a c t e r i z e d* in that the discrete set of points, in which the wave front tilt is measured, is located along straight lines, which are parallel to one of the axes of the rectangular system of coordinates.

6. A method as in claim 5, *c h a r a c t e r i z e d* in that the approximation of the partial derivatives is performed along each of the parallel straight lines, and then in the orthogonal directions.

7. A method as in claims 1, or 4, or 6, *c h a r a c t e r i z e d* in that the spline approximation along each coordinate is performed in accordance with the formula:

$$S(x)=\frac{(x_{i+1}-x)^2[2(x-x_i)+(x_{i+1}-x_i)]}{(x_{i+1}-x_i)^3}S(x_i)+\frac{(x-x_i)^2[2(x_{i+1}-x)+(x_{i+1}-x_i)]}{(x_{i+1}-x_i)^3}S(x_{i+1})+$$

$$+\frac{(x_{i+1}-x)^2(x-x_i)}{(x_{i+1}-x_i)^2}S'(x_i)-\frac{(x-x_i)^2(x_{i+1}-x)}{(x_{i+1}-x_i)^2}S'(x_{i+1}),$$

where $S(x)$ is the interpolation cubic spline along the generalized coordinate x; x_i, x_{i+1} are the coordinates of the pupil points i and $(i + 1)$ from their discrete set, at which the wave front tilt is measured having corresponding values $S(x_i)$, $S(x_{i+1})$; and $S'(x_i)$, $S'(x_{i+1})$ are the values of the first derivative in the points x_i, x_{i+1}, which ensure continuity of the second derivative $S''(x)$ in these points.

8. A method according to claim 2, *characterized* in that the numerical integration is performed in accordance with the formula:

$$W(\mathrm{P},\Phi)=W(0,\Phi)+\int_0^{\mathrm{P}}\frac{\partial W(\rho,\Phi)}{\partial\rho}d\rho,$$

where $W(\rho,\varphi)$ is the wave front function, ρ - the coordinate along the radius, φ - the coordinate along the angle, (P,Φ) are the coordinates of arbitrary pupil point, and

$$\int_0^{\mathrm{P}}\frac{\partial W(\rho,\Phi)}{\partial\rho}d\rho\approx\sum_{i=1}^{N}\frac{\partial W\left(\dfrac{\rho_{i-1}+\rho_i}{2},\Phi\right)}{\partial\rho}(\rho_i-\rho_{i-1}),$$

the interval $[0,\mathrm{P}]$ being divided into N partial portions $[\rho_{i-1},\rho_i]$, so that $i=\overline{1,N}$.

9. A method according to claims 1, 2, 3, 4, 5, 6 or 8, *characterized* in that the calculation of wave aberrations is performed based on the wave front data reconstructed in the form of splines.

10. A method according to claim 7, *characterized* in that the calculation of wave aberrations is performed based on the wave front data reconstructed in the form of splines.

11. A method according to claim 1, *characterized* in that the reconstructed wave front is used for the purposes of vision correction.

12. A method for measuring the wave aberrations of the eye, based on probing the eye at a discrete set of pupil points with a narrow laser beam, detection of the radiation scattered by the retina, measurement of the wave front tilt values in the form of first partial derivatives along known coordinates of the discrete set of pupil points in a coordinate system, approximation of the wave front in the form of functions of pupil coordinates using data from the detection of radiation scattered by the retina, and calculation of wave aberrations of the eye as deformations of an approximated wave front, *wherein* the first partial derivatives at any pupil point are determined by means of spline approximation using the data for the discrete set of pupil points, where the wave front tilt values are measured, and the wave front is reconstructed by means of numerical integration.

13. A method according to claim 12, wherein the wave front reconstructed by means of numerical integration is in a polar coordinate system and is along the radii to the pupil points with the initial point of integration located in the center of the pupil, where identical initial values of the integral are taken for all radii.

14. A method according to claim 12, *wherein* the discrete set of pupil points, in which the wave front tilt is measured, is located in a polar coordinate system along concentric circles with a common center, which coincides with a center of the radial coordinates.

15. A method as in claim 14, *wherein* the approximation of partial derivatives at the beginning is performed along each concentric circle and then along radii.

16. A method according to claim 12, *wherein* the discrete set of pupil points, in which the wave front tilt is measured, is located in a rectangular system of coordinates along straight lines, which are parallel to one of the axes of the rectangular system of coordinates.

17. A method as in claim 16, *wherein* an approximation of the partial derivatives is performed along each of the parallel straight lines, and then in orthogonal directions.

18 A method as in claims 12, 15 or 17 *wherein* the spline approximation along each coordinate is performed in accordance with the formula:

$$S(x)=\frac{(x_{i+1}-x)^2[2(x-x_i)+(x_{i+1}-x_i)]}{(x_{i+1}-x_i)^3}S(x_i)+\frac{(x-x_i)^2[2(x_{i+1}-x)+(x_{i+1}-x_i)]}{(x_{i+1}-x_i)^3}S(x_{i+1})+$$

$$+\frac{(x_{i+1}-x)^2(x-x_i)}{(x_{i+1}-x_i)^2}S'(x_i)-\frac{(x-x_i)^2(x_{i+1}-x)}{(x_{i+1}-x_i)^2}S'(x_{i+1}),$$

where $S(x)$ is the interpolation cubic spline along the generalized coordinate x; x_i, x_{i+1} are the coordinates of the pupil points i and $(i + 1)$ from their discrete set, at which the wave front tilt is measured having corresponding values $S(x_i)$, $S(x_{i+1})$; and $S'(x_i)$, $S'(x_{i+1})$ are the values of the first derivative in the points x_i, x_{i+1}, which ensure continuity of the second derivative $S''(x)$ in these points.

19. A method according to claim 13 *wherein* numerical integration is performed in accordance with the formula:

$$W(\mathrm{P},\Phi)=W(0,\Phi)+\int_0^{\mathrm{P}}\frac{\partial W(\rho,\Phi)}{\partial\rho}d\rho,$$

where $W(\rho,\varphi)$ is the wave front function, ρ - the coordinate along the radius, φ - the coordinate along the angle, (P,Φ) are the coordinates of arbitrary pupil point, and

$$\int_0^{\mathrm{P}}\frac{\partial W(\rho,\Phi)}{\partial\rho}d\rho\approx\sum_{i=1}^{N}\frac{\partial W\left(\frac{\rho_{i-1}+\rho_i}{2},\Phi\right)}{\partial\rho}(\rho_i-\rho_{i-1}),$$

the interval $[0,\mathrm{P}]$ being divided into N partial portions $[\rho_{i-1},\rho_i]$, so that $i=\overline{1,N}$.

20. A method according to claims 12, 13, 14, 15, 16, 17 or 19, *wherein* the calculation of wave aberrations is performed based on the wave front data reconstructed in the form of splines.

21. A method according to claim 18, *wherein* the calculation of wave aberrations is performed based on the wave front data reconstructed in the form of splines.

22. A method according to claim 12, wherein the reconstructed wave front is used for the purposes of vision correction.